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CANADIAN WATER WAYS

FROM THE

GREAT LAKES TO THE ATLANTIC

BY

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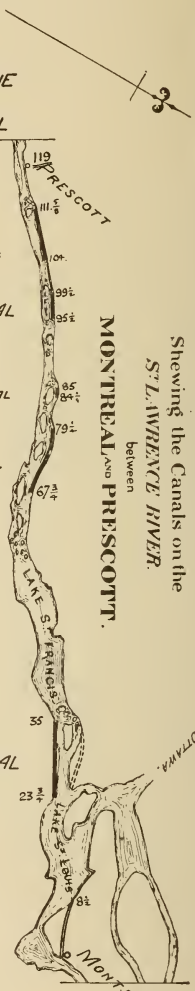
ESTIMATED COST OF LINE OF NAVIGATION BETWEEN LAKE SUPERIOR AND MONTREAL WHEN COMPLETED TO 20 FEET AT SAULT STE. MARIE AND 14 FEET FROM LAKE ERIE TO MONTREAL

EXPENDITURE PRIOR TO ENLARGEMENT	ESTIMATED COST	EXPENDITURE UP TO JANY 1ST 1892	
	$ 4.000.000	$ 719.800	SAULT STE MARIE CANAL
$ 7.693.824	16. 500. 000	16.046.900	WELLAND CANAL
	700.000		RIVER
	1. 000. 000		GALOPS CANAL UPPER PART 1⅛ MILES
	700.000	1. 850. 800	RAPIDS OUTSIDE OF GALOPS CANAL
1. 339. 038	1. 600. 000		RAPIDE PLAT CANAL
	30. 000		RIVER
	600. 000		FARRANS POINT CANAL
1. 945. 624	4. 000. 000	2. 197. 900	CORNWALL CANAL
	90. 000		LAKE ST FRANCIS
(BEAUHARNOIS CANAL) 1. 611. 690	4. 750. 000		SOULANGES CANAL
		100. 400	LAKE ST LOUIS
	1, 250. 000		
2. 626. 241	7. 800. 000	6, 549 200	LACHINE CANAL
15. 216. 477	43. 020. 000	27465 000	
	27.465.000		
	15, 555. 000		
GALOPS CANAL LOWER PART 6¼ MILES IF ACQUIRED	1. 700. 000		
	17. 255. 000		



CANADIAN WATER WAYS FROM THE GREAT LAKES TO THE ATLANTIC.

I have been requested to contribute to the World's Water Commerce Congress a brief communication upon "New and Enlarged Water Ways Required to Meet the Wants of Canadian Commerce," with special reference to a "Proposed Enlargement of the Welland Canal and Improvement of the St. Lawrence River."

The second enlargement of the Welland Canal was only completed about five years ago, and that of the St. Lawrence Canals is so far advanced that its completion is expected in about two years. It can hardly be said, therefore, that the demands of Canadian Commerce call for "new and enlarged water ways," at least until completion and trial of these unfinished works. It is true that these canals are not large enough for the best craft upon the Upper Lakes, and doubtless Canadian Commerce would be benefited if they were larger; but it is yet to be shown that their present size is insufficient for the object for which they have been constructed.

The Government Commission, which fixed the dimensions for the enlarged locks for the Canadian Canals in 1871, consulted the Boards of Trade of Oswego, Toledo, Detroit, Milwaukee, and Chicago, with the following result:—

Oswego	recommended	the	length	to be	250 ft.,	width,	45 ft.,	depth,	14 ft.		
Toledo	"	"	"	"	215 "	"	45 "				
Detroit	"	"	"	"	250 " to 275 "	"	45 " to 55 "	"	15 " to 16 "		
Milwaukee	"	"	"	"	300 "	"	50 "	"	15 "		
Chicago	"	"	"	"	250 " to 300 "	"	35 " to 45 "	"	14 "		

Canada took her average from Chicago, and chose 270 feet x 45 feet x 14 feet. This is the less surprising now, when it is remembered that all the above eminent United States authorities were, in the language of the Exchange, "short" on the lock question in 1871.

As to new Canadian water ways, the only proposed ones which have been regarded as of general importance, are a canal from Lake Huron to tide water at Montreal by the valleys of the French and Ottawa Rivers, and another (almost a continuation of the above) from the St. Lawrence above Montreal to Lake Champlain. Neither of these are at present called for by the demands of Canadian Commerce. An Ottawa route to the Upper Lakes would not serve the more important Canadian interests upon the route of the St. Lawrence and the Welland, nor would it reach anything upon those Lakes which is not equally open to the Welland route upon a larger, and therefore more economical scale. The connection between the Upper St. Lawrence and Lake Champlain would not serve any important Canadian interest until the water route was extended to the Hudson River upon the same scale. Such a canal must therefore form part of an International System.

The "new and enlarged Canadian water ways," and "St. Lawrence River improvement," referred to in the programme, are, therefore, I suppose, those required with special reference to the enlarged scale for lake navigation, decided upon by the United States Government, and to the Northwestern demand for an extension of this scale to the Atlantic, either by the St. Lawrence or the Erie Canal. The St. Lawrence will undoubtedly give the shortest, quickest, and cheapest route between the Atlantic and the Upper Lakes, while the Erie Canal route will reach by the shortest line the great domestic markets near the Hudson. A St. Lawrence route to reach these markets *via* Lake Champlain, may, however, prove to be attainable at less cost in construction and in working than the other non-international one.

THE ST. LAWRENCE ROUTE.

The above heading covers the whole Canadian water route from Lake Superior to the sea, and includes the St. Lawrence canals between tide water and Lake Ontario, the Welland Canal between Lakes Ontario and Erie, and the Sault Ste. Marie Canal between Lakes Huron and Superior.

Prior to the construction of the Erie and Champlain Canals, Vermont and Northern New York were wholly dependent upon the St. Lawrence, and large quantities of wheat and flour were exported to the West Indies and elsewhere in the closing years of the last, and the early ones of the present century. Small cut-stone locks were built before 1785 at necessary points on the St. Lawrence for the passage of the batteau,—a flat-bottomed skiff about the dimensions of the Venetian Gondola. These were enlarged in 1804 to pass American barges, known as "Durham Boats," having a capacity of 350 barrels of flour—ten times that of the batteau.

In 1798 a Canadian fur company of Montreal constructed a wooden lock for the passage of batteaux at Sault Ste. Marie.

Although a boat canal with masonry locks was opened in 1825 from Montreal to Lachine, the line of St. Lawrence Canals was not completed until 1848, notwithstanding that the Welland Canal had been in operation since 1829. This was because the Military Canals on the Ottawa and Rideau routes connected the Lachine Canal with Lake Ontario.

In 1848, therefore, Lake Erie was for the first time opened to the sea for masted vessels; and in 1849 a Cleveland schooner sailed down the St. Lawrence and around Cape Horn to San Francisco.

The canals between Lake Erie and Montreal are upon the uniform dimensions of 270 feet length between the gates, 45 feet width between the walls, and 14 feet depth on the miter sills. The single lock at Sault Ste. Marie, to be completed next year, will have a length of 900 feet, a

breadth of 60 feet, and a depth of 19 feet at extreme low water on the miter sill. The length lockage and position of the several canals are as follows:—

From Montreal to the head of the St. Lawrence Canals (which is about 8 miles below Ogdensburgh), the distance is 111⅝ miles, of which 43⅜ miles are canal, 48 miles lake, and 20 miles river. Commencing at Montreal, the distribution and the names of the St. Lawrence Canals are as follows:—

Canals.	Length.	Locks.	Lockage.	Distance between Miles.
Lachine,	8½ miles,	5,	45 feet, thence to Beauharnois Canal (Lake St. Louis)	15¼
Beauharnois,	11¼ miles,	9,	82½ feet, thence to Cornwall (Lake St. Francis)	32¾
Cornwall,	11½ miles,	6,	48 feet, thence to Farren's Point (River)	5
Farren's Point,	¾ miles,	1,	4 feet, thence to Rapide Plat (River)	10½
Rapide Plat,	4 miles,	2,	11½ feet, thence to Galops (River)	4½
Galops,	7⅜ miles,	3,	15½ feet.	
Total,	43⅜	26	206½	68

The Soulanges Canal, now being substituted for the Beauharnois, will have the same lockage (with 5 locks instead of 9), but nearly 3 miles greater length, the Lake distance being decreased to this extent.

From the head of the St. Lawrence Canals to the foot of the Welland Canal the distance is 226 miles, of which 160 are in Lake Ontario. The Welland, is 26¾ miles long, and as now enlarged has 25 locks, with a total lockage of 326¾ feet,—all embraced in the first 10 miles from Ontario.

From the head of the Welland Canal to the foot of the Canadian Canal at Sault Ste. Marie the distance is about 600 miles. The length of the Sault Canal upon the Canadian side is 3,500 feet, with one lock of 18 feet lift; but the under-water excavation, for deepening the approaches to the 19 feet depth at extreme low water, will be several times the length of the visible canal. The total length of canal and approaches is 18,100 feet. From the Sault to Port Arthur is 266 miles, and to Duluth 390 miles. The completion of the Canadian Canal at the Sault, will there-

fore extend Canadian inland navigation, from the ocean vessel at Montreal, over 1,400 miles of fresh water, with less than 74 miles of canal; and with 551 feet of lockage to reach Lake Superior, the surface of which is about 600 feet above tide.

Although Canada is only now constructing a canal to reach Lake Superior, this completion of the Canadian system has always been kept in view. In 1846, and again in 1852 (before the canal was commenced upon the Michigan side), the Province of Canada made surveys and estimates for a canal at the Sault, and it was included in the scheme of the Canal Commission appointed by the Dominion of Canada about 25 years later. At neither of these dates was there any Canadian commerce upon Lake Superior, and this is the strongest evidence that the Canadian Canals looked chiefly to the Northwestern States of the Union for their support. This is also confirmed by the history of the Welland Canal, which was first built by a joint stock company, having its principal shareholders in New York and England, as also by the fact that the Canal Commission of 1870 were instructed to advise "the best means to attract a large and increasing share of the trade of the Northwestern portion of North America through Canadian waters, such as will enable Canada to compete successfully for the transit trade of the great Western country."

The locks of the Canadian canals, with the exception of those now under construction at the Sault, and the Soulanges Canal, have moderate lifts, and are repetitions of the simple and economical features of the original Welland Canal. The lock floors are of wood, and their upper gates of the same height as their lower ones, the filling and emptying being through valves in these gates.

The Soulanges Canal, as well as that at Sault Ste. Marie, are new departures. The chambers are filled and emptied by culverts in the side walls or floor, which, in the first, is of masonry, and the upper gates rest upon curved breast walls. Electric motors driven by water-power current will work

gates, automatic sluices at weirs, as well as swing bridges opening the full width of the channel without the usual central pivot pier. Portland cement concrete will generally be substituted for masonry in the Soulanges works.

As part of the "Improvement of the River St. Lawrence," the submarine work below Montreal should not be overlooked. These are submerged canals larger in width and greater in length than those upon the river above. After about 40 years' work, up to the time of the completion in 1888, the depth for sea-going vessels at low water has been increased from 11 to 27½ feet, at a total cost of about $4,000,000, of which $500,000 was for dredging plant.

The total length of channel deepened is about 50 miles, of which about 18 are in Lake St. Peter. There is a continuous cutting of about 16 miles in the bottom of the lake, 300 feet wide, and ranging from 15 to 17 feet in depth. The total quantity dredged is about 20,000,000 cubic yards. This would show an average cost of 20 cents per cubic yard; but the average for the great bulk or three-fourths of the quantity was about 16½ cents per yard, including an allowance of $1\frac{7}{10}$ cents per yard for depreciation of plant. For Lake St. Peter alone the cost has been reduced (by improvement and enlargement of the dredging plant) from 11½ cents per yard in 1875, when dredging for 22-foot channel, to 2.91 cents in 1888 for the 27½-foot channel; the average for the whole of the dredging in Lake St. Peter being 4.98 cents per cubic yard. The cost of deep-water dredging in 1889, in shale rock, hard pan and bowlders, ranged from 35 to 40 cents per cubic yard, or 13 times the latest cost for the same depth in the silt formation of Lake St. Peter.

THE CHAMPLAIN AND ST. LAWRENCE CANAL.

The Richelieu River (the outlet of Lake Champlain) is, at St. Johns, 25 feet higher than the St. Lawrence at Caughnawaga, foot of Lake St. Louis, and about 25 miles distant upon a straight line. If Lake Champlain be made

the feeder, a canal 32½ miles long would be required to avoid high ground upon the direct route. To surmount this high ground, and take shortest route for the canal, would call for a feeder 38 feet higher than Lake Champlain and 16½ miles in length, and would treble the lockage. The direct route would give 100 feet lockage upon a 25 mile canal, against 25 feet lockage on a canal about 8 miles longer. It has been proposed to take this feeder from the Beauharnois Canal and to make it the canal for Western traffic, connecting it with Caughnawaga by a branch about 4 miles long. This would give for the Western trade 38 miles of canal with 37½ feet of lockage, against 28 miles of canal with 137 feet of lockage on the Caughnawaga route, because the feeder would start out from the Beauharnois canal 63 feet higher than Lake St. Louis, and at a point 3 miles from that lake. This 3 miles of the Beauharnois canal is, therefore, added to the 25 miles of the direct Caughnawaga route.

This route would make the St. Lawrence the feeder, giving the minimum lockage, as well as distance, for the most important traffic, the Western trade. The ground upon this route is favorable, for two thirds of its length, for a canal of 200 feet or more in width, at same cost as for a narrower one.

If Lake Superior were brought into connection with Lake Champlain, for large lake craft, New England and Northern New York would be reached, and Boston thereby obtain an advantage which might induce New York to extend such a navigation to the Hudson River. As such a canal would be of more importance to the Western States and New England than to Canada, it must await their action. The interest of the Ottawa lumber trade in this route has been considerably diminished in the last 20 years, by the annually increasing quantity of lumber which now takes the rail from the mill in Canada to the yard in the United States, in preference to the water route.

Lake Champlain between Rouse's Point and Whitehall

is called 120 miles. St. Johns on the Richelieu River (where the Chambly Canal begins) is 24 miles river navigation from Rouse's Point. From Whitehall about 66 miles of canal reaches the Hudson River, and from St. Johns 38½ miles of canal would reach the St. Lawrence (about 105 miles of canal between the Hudson and St. Lawrence); and between the points of junction on the Beauharnois Canal and Lake Erie about 60 miles more of canal.

The distance from Lake Erie to New York *via* Lake Champlain would be about 216 miles longer than that by the Erie Canal. If the canal from Lake Champlain to the Hudson River were fed from this lake (as the only sufficient source of supply), the lockage would be nearly equal upon the two routes. There would be 216 miles more distance of lake and river navigation on the one route, and 190 miles more canal on the other; but as the first would be traveled about three times as fast as the second, the time of transit (which is the measure of the cost) would be in favor of the longer route.

The cost of construction upon the two routes would be largely in favor of the longer route. These comparisons are based upon the longer route for a canal between the St. Lawrence and Lake Champlain, to be fed from the former; and not upon the Caughnawaga route, fed from Lake Champlain, in which case that lake might be called upon to feed three canals.

The cost of these routes cannot be compared without surveys and estimates on the scale adopted for the Lakes, and especially as to cost of ship canal between Lake Champlain and the Hudson River.

THE OTTAWA VALLEY CANAL.

The Ottawa Route.—This route would shorten the distance between Montreal and Lake Superior about 350 miles, and therefore has been advocated for a ship canal. Surveys were made and reports given in 1858 and 1860 on

a basis of 10 feet of depth of navigation, with locks 250 x 50 feet, and of 12 feet with locks 250 x 45. The first estimate was $24,000,000, and the second, though for deeper water, was $12,000,000. In the second, there were more dams proposed and less canals,—58 miles of canal for the first, and 29 miles for the second.

The distance from Montreal to the mouth of the French River in the Georgian Bay, Lake Huron, is about 430 miles, of which 308 are in the Ottawa, and the remainder in the Mattawa and French Rivers. About 180 miles would be wide-water lake navigation, alternately deep and shoal, and 250 miles of river. The summit at Lake Nipissing is 640 feet above the sea, and is 66 feet higher than Lake Huron. The lockage would be at least 666 feet, against 533 feet *via* Lake Erie.

The Canadian Canal Commission of 1870 postponed the consideration of this route, on the ground of the wide discrepancy in the estimates, which were made on the basis of 10 and 12 feet. Now that Parliament has adopted 14 feet for the St. Lawrence, and the United States 20 feet for the Upper Lakes, a revised estimate is needed and a fuller survey to determine what depth of navigation is practicable upon this route. It will probably be found that, upon any scale of navigation, the increased lockage and the reduced speed necessary upon the greater portion of this route would fully counterbalance the shorter distance. Both the estimates above referred to were based upon raising the summit level, which is Lake Nipissing; but the subsequent construction of the Canadian Pacific Railway and the present existence of towns and villages (as well as the railway) on lands intended to have been flooded by this work, make this raising of the lake now out of the question.

The Ottawa route would be shortest only for Lake Michigan, Georgian Bay, and Northern Michigan and Lake Superior; but not for Lake Erie or the Detroit River. The receipts and shipments at Buffalo, including Tona-

wanda, are greater than of any other lake port. Beside Buffalo, there are Cleveland, Ashtabula, Sandusky, Toledo, and Detroit, the aggregate tonnage of which is greater than either Buffalo or Chicago. These the Welland route reaches in addition to all which an Ottawa route would reach.

THE GRANGERS CANAL.

The Northwestern grain trade—because of the distance of the best and greatest extent of wheat lands from the ocean where market value is established—calls for the largest and deepest, in order that it may be the cheapest practicable water way between Lake Superior and the Atlantic seaboard.

For such a canal the St. Lawrence route—of which the average channel depth between the rapids is over 30 feet, with ample width—offers advantages to be found upon no other.

From Lake Erie there would be about 75 miles of canal to reach the ocean, as against about five times that length of artificial channel upon the New York State route.

To reach New England on Lake Champlain there would be less than 100 miles of canal, against 400 miles of made channel *via* Buffalo, Troy, and Whitehall.

To reach New York, there would be about 164 miles of canal against more than double that length of artificial channel by the Erie Canal route. On the other hand, the total length of the water route *via* the St. Lawrence and Lake Champlain to New York, would be about 216 miles longer than that *via* the Erie Canal.

Montreal is the only city upon the route of these Canadian canals. There is not, therefore, on this route, that growth of vested interests to be interfered with by enlargement, such as exists upon the Erie Canal route. The banks of the St. Lawrence are everywhere low, and, therefore, favorable for canal purposes, and there are the two shores which may be occupied throughout for an international system of double track canals, such as the traffic of the Upper Lakes will soon call for.

The Beauharnois Canal on the south shore—which has nearly double the lockage of any of the other St. Lawrence canals—is not being enlarged, but a new canal is under construction on the north shore overcoming the same rapids. When this latter—which is called the Soulanges Canal—is in operation, the Beauharnois route will be freed for future enlargement, which may then be carried on in summer as well as in winter, upon any desired scale.

What the enlarged St. Lawrence Canals will be capable of has been established by what is doing at the Welland. On this canal steamers 254 feet long by 42 feet beam carry 1,825 tons on 14 feet draft through the canal, and 2,300 tons on 15 feet draft through the Lakes. About 400 tons are usually lightered, at a cost of 80 cents per ton, involving a detention of from 6 to 8 hours. The capacity of their lower holds is 70,000 bushels, and as much as 112,000 bushels of oats have been carried in the hold and between decks. These vessels are loaded to the draft in the St. Mary's, Detroit, and St. Clair Rivers; and as those are deepened, their draft in the Lakes and their lighterage at the Welland, and consequent detention there, will be increased. The American craft go to Oswego and Ogdensburgh, the Canadian to Kingston, although they could also go to Ogdensburgh if coming from a Canadian port, or to Prescott, opposite. At Kingston and Ogdensburgh grain is transshipped into barges for Montreal, the lake vessels seldom descending to that city. While the St. Lawrence Canals have only had 9 feet of water, the second Welland had more than 10, and lightering there had also been generally resorted to. In less than three years it is expected that the Welland class of vessels will be able to proceed to Montreal, and the important question now is, will they go there? The Canal Commission of 1870,—the chairman of which (the late Sir Hugh Allan) was a great shipowner,—referring to the Ottawa route, said that it "will be admirably adapted for a barge navigation similar to that which now obtains upon the River St. Lawrence, and, as appears by evidence,

by far the cheapest means of transport." The Commission increased the length of the old St. Lawrence locks 30 per cent, and the depth of water in them 33 per cent, but they did not express any opinion as to whether barges 250 feet long and drawing 12 feet of water would be employed, or whether the Lake vessel would descend to Montreal. It is the opinion of some engaged in this transportation that barges not exceeding 10 feet draft, or 50,000 bushels capacity, will prove to be the most convenient and profitable size.

The objection to a barge system is, that it is, on such a route, necessarily a monopoly. The Erie Canal has a towpath, and individual boat owners can travel on it as a highway,—so had the Welland in the days of horse-power towage,—but the Lake and river navigation of the St. Lawrence and the Ottawa and Rideau routes require tugboats. Such a monopoly as existed upon the Military Inland Route, when there was no other, and no railways, can only exist upon the St. Lawrence as long as it is tolerated by the Lake vessels. The Upper Lake vessels have outgrown our canals, so that lighterage is necessary, and this may be increased to the extent of half the cargo; and then it will be seen whether they will lighter the whole, as at present, a portion only, as on the Welland, or none.

In connection with this question of lighterage or transshipment, if it is to be maintained, the grain trade of the St. Lawrence will, I believe, require an extensive system of elevators at Prescott, Canada, as well as those at Ogdensburgh, opposite, and that both the Grand Trunk and the Canadian Pacific Railways should be connected with them, so that the ocean steamer at Montreal may not be detained or sent away empty in the event of any interruption by frost or accident to the navigation in the canals.

Montreal has an exceptional harbor, in that its wharves are under water from December until April,—the result of a winter rise of the water in her harbor caused by the packing of ice below the city. The current of the St. Law-

rence meets the tide in Lake St. Peter, although salt water does not come within a hundred miles of it, and the descending ice is first checked there. It then backs up and accumulates so as to raise the harbor from 10 to 15 feet above its summer level. In settling into its winter bed, and in arousing from it in the spring, the ice shoves landward with such force as to prevent the erection of warehouses or elevators at the wharf front. Ocean steamers are loaded at their berths with grain afloat in the harbor, transferred by floating elevators; and it is, therefore, contended that for Montreal, and for so long as the present system continues, barges as floating warehouses are the most economical.

Extensive harbor improvements are now in progress, including the elevation of the wharves and the construction of a guard wall to protect them, and warehouses upon them —from the ice shoves. These improvements will give over 4 miles of deep-water wharfage, nine tenths of which will be 25 to 27½ feet deep, and none less than 20 feet, at a cost of about $3,000,000.

The charge for barge transport from Montreal to Kingston, 180 miles, is as great or greater than for 1,000 miles of Lake transport, including the Welland Canal. This charge must come down, or the Upper Lake vessels will go down. Some of those vessels will undoubtedly go through, and all would do so if sufficient return freight is attracted to the St. Lawrence by its enlarged inland route to the Lakes. Tariffs and navigation laws may delay and hamper; but when possible ocean rates meet possible inland ones, this route can have no competitor in time and cost, and long before any other is provided it will become indispensable to the rapidly congesting traffic upon the Upper Lakes.

The grain trade of the St. Lawrence route has until recently been stationary, because it was confined to that which Montreal capital brought there. British and foreign capital, British steamers and mail subsidies, have assisted New York's enormous advantages; while Western

railroads and Western shipments were controlled by New York and New England, the chief destination of all not exported. The effect of the Reciprocity Treaty while it lasted was to direct Canadian exports for Britain *via* New York, and away from the St. Lawrence. This grain trade is now increasing, and a greater quantity was shipped in 1892 from Chicago and Duluth on through sales,—an indication that the St. Lawrence route is growing in favor with Western exporters.

The receipts and shipments in bushels for the last five years were :—

	1892.	1891.	1890.	1889.	1888.
Receipts,	28,508.007	24,176,289	18,215,063	18,722,865	14,711,465
Shipments,	24,355,965	18,651,409	13,550,974	15,257,678	10,207,802

In the above, flour is converted into bushels of wheat.

The canals of Canada were undertaken after the completion of the Erie Canal, and their projectors counted upon something proportionate to the splendid financial success of that work. They were begun before the railway era, and enlarged at a time when no one foresaw the effect of railway competition. New York at first protected the Erie Canal against that competition by legislation, and it was not until 1851 that the Central was permitted to carry freight without paying canal tolls. Until 1844 railroads paralleling the canals of the State were prohibited from carrying anything but passengers and their baggage. In that year certain roads were permitted to carry freight during the suspension of navigation, and then only upon the payment of canal tolls to the State. But it was the great invention of Bessemer which, bringing about the substitution of steel for iron in the rails, enabled the railways to lower their rates and compelled the State of New York to come to the relief of her boatmen, in 1882, and entirely remove the tolls.

The railways have revolutionized the conditions under which former canal enlargements have been undertaken; and our canals, instead of becoming, as expected, a source

of revenue, have become a charge upon the public purse. Under these circumstances, therefore, it is clear that nothing more can be expected from Canada at present than the completion of her unfinished and long-delayed enlargements.

The cost of the Canadian canal system between tide water and Lake Superior by the St. Lawrence route will aggregate about $60,000,000 — a sum which, however great, is less than Manchester is now paying for a ship canal not half the length, and with but a fraction of the lockage of the Canadian system, in order to compete with the oldest railway in the world. The Erie canal has cost upward of $50,000,000, but is maintained a free canal, and a railway freight regulator at an annual cost to the State of New York of $720,000.

It may cost as much more, as Canada has already expended, to carry a canal of the size needed for the longest lake steamer, with over 20 feet water, from Lake Erie to Montreal; but whatever the sum may prove to be, it would not be more than 20 per cent of that upon any purely United States route. But there are many reasons why such a work will not be undertaken, unless as an international one, such as led to the improvement of the navigation of the Danube and Rhine.

Canada, of course, will not consider it while her enlarged canals are incomplete on the St. Lawrence, and their value not tested, especially as against the barge system in operation there. For her own wants her new canals will afford an outlet better than she can find elsewhere. Her need of the Welland Canal has been less than that of the United States, because the peninsula of Ontario, the richest portion of the Dominion, and bounded by three great lakes, can ship from the lower one, below the Welland Canal. But her recent developments in her prairie provinces will make Lake Superior her greatest grain-shipping center, and her distant prairies will then need the most rapid and economical route to the sea.

There is, moreover, not the same unanimity in Eastern Canada as exists in the Western States, as to the benefits to be derived from a through commerce for which Montreal and Quebec would be way stations. Lastly, there is disagreement as to the economy of extending the voyage of the Lake vessel to Europe, and of its practicability, under all circumstances, with a fresh-water crew.

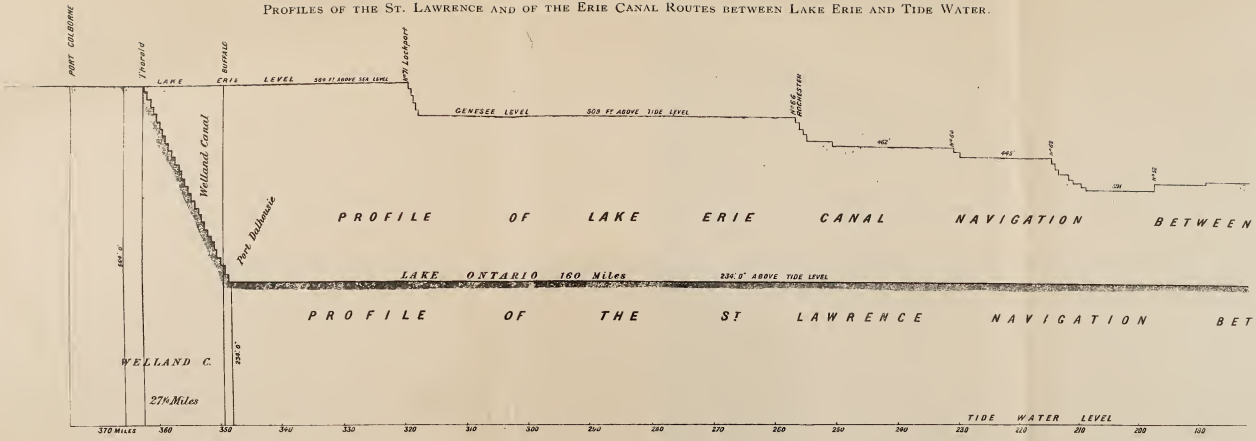
Whenever the 14 feet draft is obtained, whatever may be the outcome of the barge question, there will be Lake vessels descending to Montreal, and vessels coming from and going to sea *via* the St. Lawrence and Welland Canals. Colliers will come from Nova Scotia into Lake Ontario, if no farther, and fruit vessels from the Mediterranean and the West Indies will penetrate to Lakes Michigan and Superior, and will not fail to get return cargo. The St. Lawrence affords the shortest water route between Europe and the Upper Lakes.

The next further enlargement which may be undertaken by Canada with respect to canals, will be confined to lengthening the locks, which is practicable at reasonable cost. When this is done nearly every Lake craft now afloat could pass out to sea with 14 feet draft, and load down to 20 feet or more at Montreal. There are over 2,500 steamers in Lloyd's Register of less width, but of greater length, than the Canadian lock chambers. The modern proportions of length to beam are 8, 9, and 10 to 1. The Canadian Commission adopted the proportions of Noah's Ark, and made the lock chambers 6 to 1. At present the tendency is toward an increase of beam in proportion to length, and there may be a return to these scriptural proportions in future naval architecture; but this will not increase the capacity of those locks, though it may prove that they are not too short for their width or too wide for their length.

Imperfect as they are, they have brought the caravels of Columbus to Chicago.

Ottawa, Canada, July, 1893.

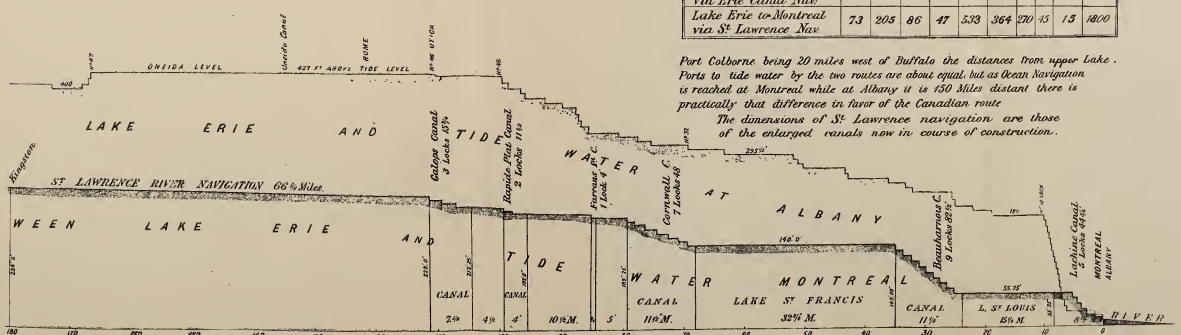
Profiles of the St. Lawrence and of the Erie Canal Routes between Lake Erie and Tide Water.


PORT COLBORNE
Welland Canal
Port Dalhousie
LAKE ERIE LEVEL 565 FT ABOVE SEA LEVEL
GENESEE LEVEL 568 FT ABOVE TIDE LEVEL
PROFILE OF LAKE ERIE CANAL NAVIGATION BETWEEN
LAKE ONTARIO 160 Miles 234.0' ABOVE TIDE LEVEL
PROFILE OF THE ST LAWRENCE NAVIGATION BET
WELLAND C.
27⅞ Miles
TIDE WATER LEVEL

Comparative Statement.	Miles Canal Nav.	Miles Lake Nav.	Miles River Nav.	Nº of Locks	Lockage	Total Distance Miles.	Dimensions of Locks. Length	Width	Depth of Water	Capacity Tons
Lake Erie to Albany via Erie Canal Nav.	352	"	"	71	654	352	110	18	7	220
Lake Erie to Montreal via St Lawrence Nav.	73	205	86	47	533	364	270	45	15	1800

Port Colborne being 20 miles west of Buffalo the distances from upper Lake Ports to tide water by the two routes are about equal. but as Ocean Navigation is reached at Montreal while at Albany it is 150 Miles distant there is practically that difference in favor of the Canadian route

The dimensions of St Lawrence navigation are those of the enlarged canals now in course of construction.


ONEIDA LEVEL 427 FT ABOVE TIDE LEVEL
LAKE ERIE AND TIDE WATER AT ALBANY
ST LAWRENCE RIVER NAVIGATION 66⅔ Miles
WEEN LAKE ERIE AND TIDE WATER MONTREAL
Oswego Canal
Cayuga Canal 3 Locks 15⅔
Rapids Plat Canals 2 Locks 11½
Farmers' C. 1 Lock 8
Cornwall C. 7 Locks 48
Beauharnois C. 9 Locks 82½
Lachine Canal 5 Locks 44½
CANAL 7½ 4½ 4' 10½ M. 5' 11½ M.
LAKE ST FRANCIS 32½ M.
CANAL 11½'
L. ST LOUIS 15½ M.
RIVER

The EDITH *and* LORNE PIERCE
COLLECTION *of* CANADIANA

Queen's University at Kingston